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GB 1267649

US 3917013

GB 1564426

GB 1175309

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## (54) Brake-steering in a motor vehicle

(57) A brake-steering system for a motor vehicle, especially a tractor or an agricultural machine, comprises a steering-braking change-over valve (2) functionally connected with both the braking system and the steering system of the vehicle. The valve (2) is arranged to be actuated by the steering system at a certain, preferably the maximum, turning angle of the steerable wheels, whereby a control piston of the valve (2) is deflected out of a neutral or central position, in which it is otherwise constantly held by springs and in which a master cylinder (5) stands in communication with all wheel brake units (8, 8', 10, 10') for braking during normal operation, into a respective end position which corresponds to the direction of the turning angle and in which the master cylinder stands in communication only with the brake unit (8 or 8') of the associated rear wheel able to be brake-steered.

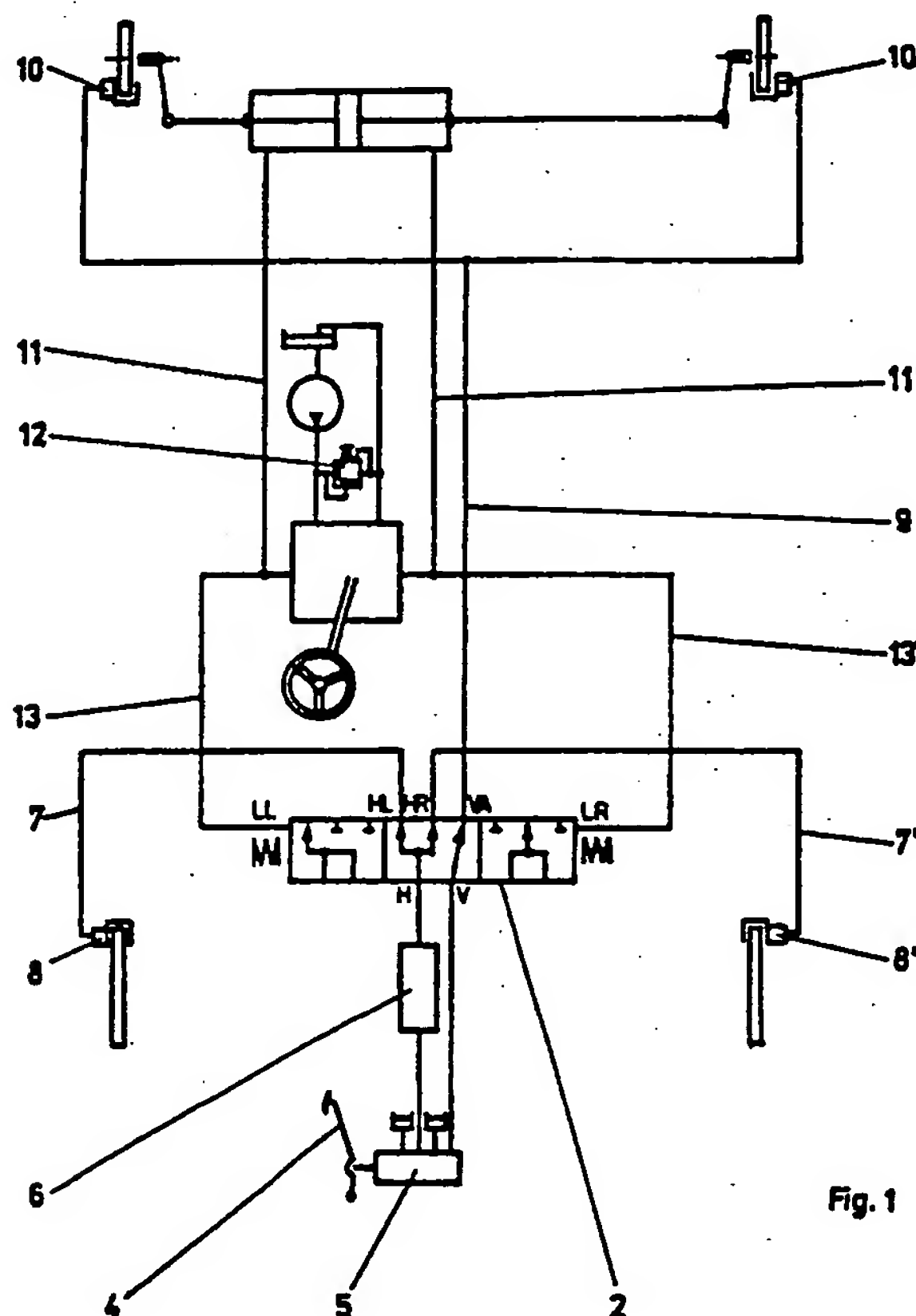


Fig. 1

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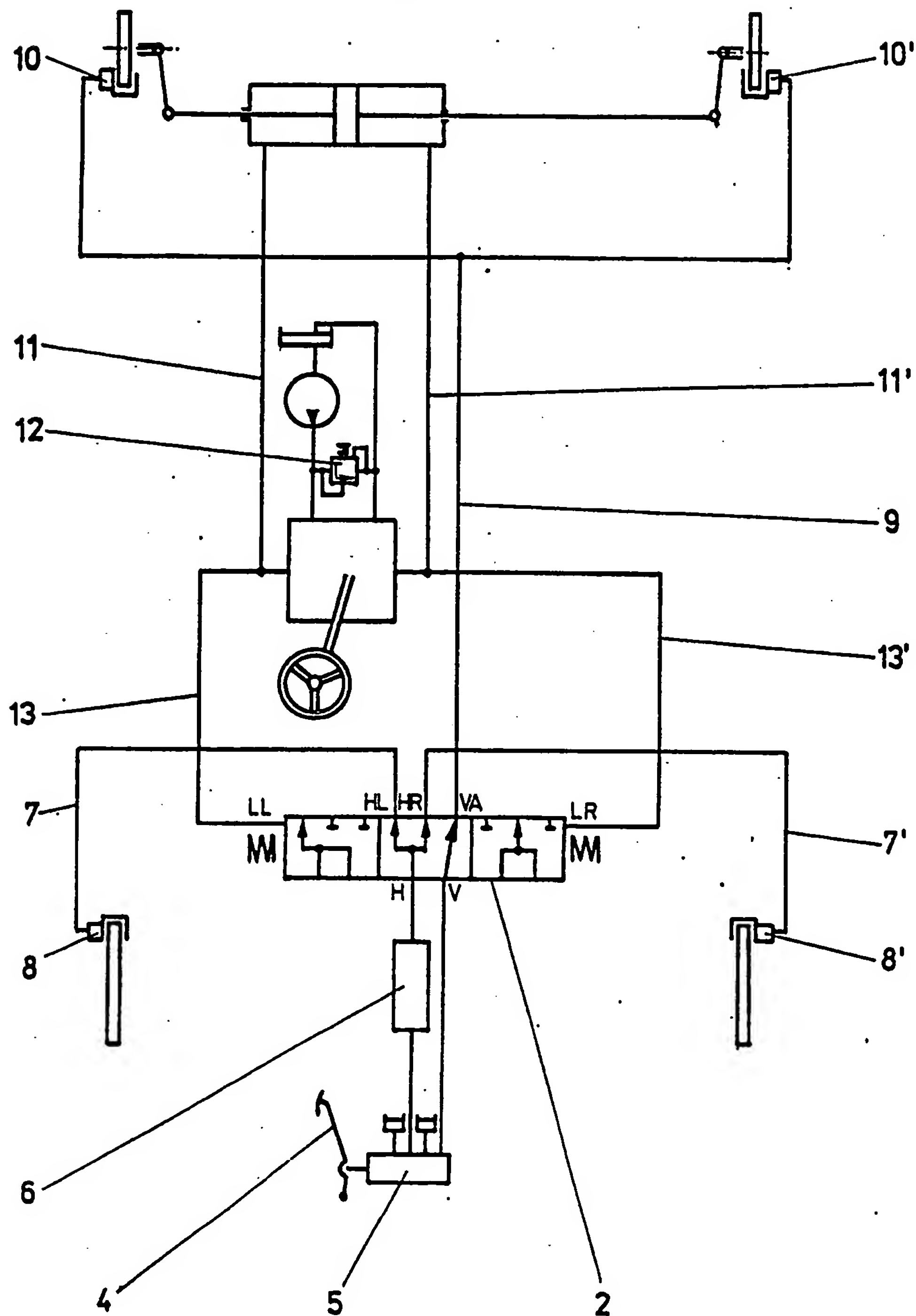


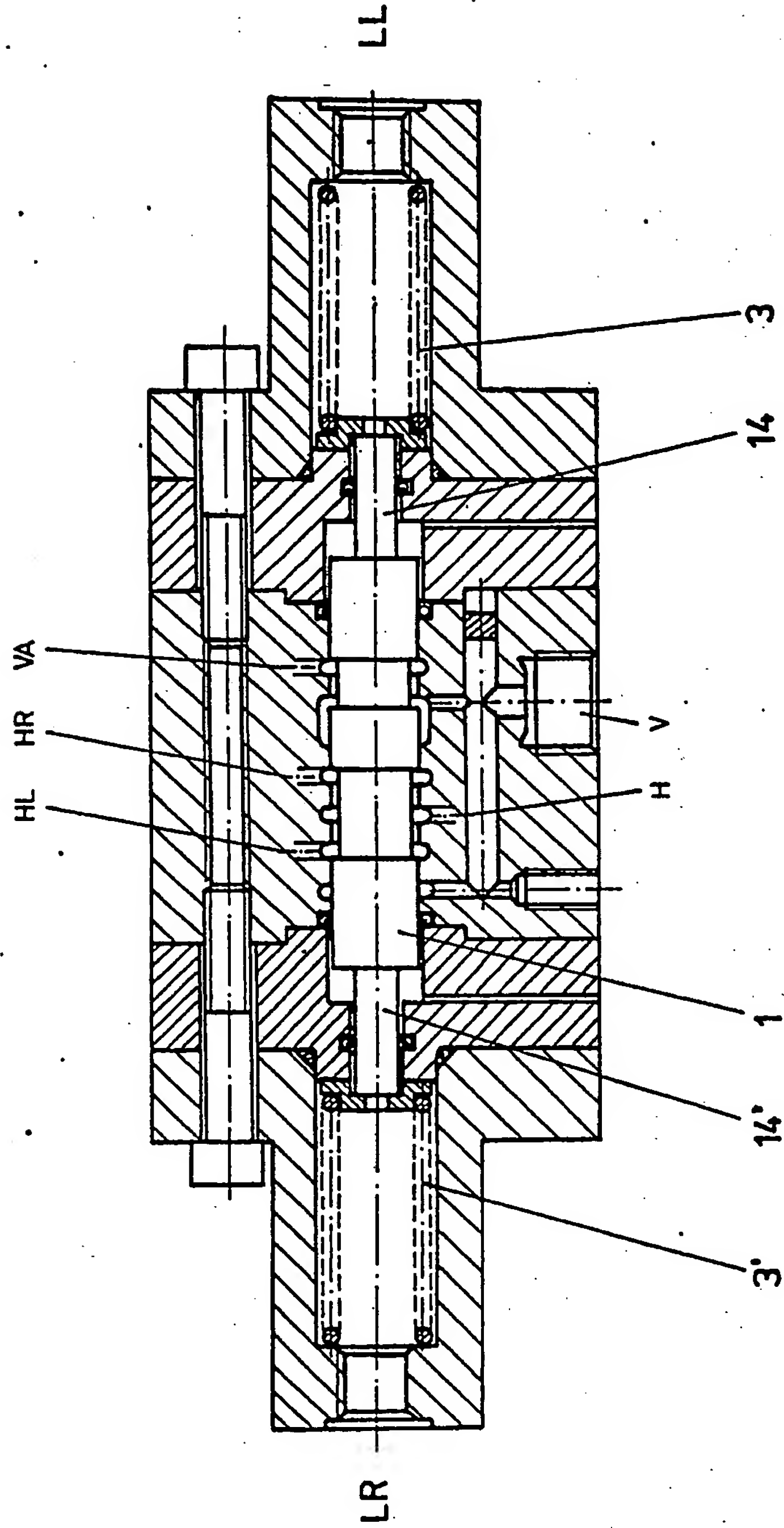
Fig. 1

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Fig. 2



## SPECIFICATION

### Brake-steering in a motor vehicle

5 The present invention relates to motor vehicle with brake-steering assistance, especially a tractor or an agricultural machine.

Steering-braking systems are widely employed in motor vehicles which are used not only for normal travel operation on the road but also for cross-country travel. In order to achieve the smallest possible turning radius without interrupting the drive, one side of the vehicle is braked by means of the system, whilst the other side continues to drive by way of the differential.

The braking systems of such vehicles have some unusual constructional features compared with normal braking systems.

20 In principle, two forms of steering-braking systems are known:

1. By means of a manually actuatable brake change-over valve (preselector valve), the pressure fluid feed from the master cylinder can be controlled selectably (DE-AS 1 480 312) to the cylinders of all wheel brake units (braking during normal travel operation) or to only the cylinder of one of two brake units serving for steering assistance (steering-braking). This form of steering-braking system—one braking pedal and one manually actuatable brake change-over valve—has the disadvantage that erroneous operation, for example forgetting to return the brake change-over valve to the neutral or central setting, is possible, which would give rise to danger when normal braking is intended.

2. The steering-braking system consists of two tandem main brake cylinders with two brake pedals as actuating elements (DE-OS 3 218 293). A disadvantage of this construction is that the actuation of the brake pedals together (braking during normal travel operation) or selectably singly (steering-braking) is not easy to carry out. Moreover, the presence of two brake pedals does not exclude erroneous operation.

Both known systems moreover have the defect that for preselection of steering-braking, or after steering-braking, the driver has to carry out additional necessary actions or manipulations (actuation of the brake change-over valve or unlocking or locking of the brake pedals), which requires a high level of concentration from the driver. Moreover, the possibility exists in both systems of performing steering-braking without the steering wheels having been deflected into the respective direction, which can lead to high chassis loading and tyre wear.

There is thus scope for improvement of brake-steering systems in respect of operation and safety, especially by limiting the system to a single brake pedal and without additional operating elements such as preselector equip-

ment and yet making possible braking during normal travel operation as well as brake-steering.

According to the present invention there is provided a motor vehicle with brake-steering assistance, the vehicle being provided with a valve which is arranged in a pressure fluid path to wheel brake units of the vehicle and which comprises a valve element movable between an intermediate position permitting transmission of actuating fluid pressure to all of the brake units and two end positions each associated with a respective direction of turning of steerable wheels of the vehicle and each permitting transmission of actuating fluid pressure to only a brake unit at the side of the vehicle facing in the respective direction, means to urge the valve element into its intermediate position, and means so responsive to turning of the steerable wheels to a predetermined angle in either direction as to cause the piston to be displaced into the end position associated with the respective direction.

In a preferred embodiment, the valve is connected functionally with the braking system as well as with the steering system of the motor vehicle and comprises a control piston driven by the steering system at a certain, preferably the maximum or nearly the maximum, turning angle of the steerable wheels, the piston then being displaced out of a neutral or central position in which a master cylinder stands in communication with all wheel brake unit cylinders for braking during normal travel operation and into an end position which corresponds respectively to the direction of the turning angle and in which the master cylinder stands in communication only with the wheel brake unit cylinder of the respectively associated wheel able to be brake-steered.

The drive of the valve element can take place directly through the pressure fluid of a power steering system as well or by electromagnetic means.

An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram of braking and steering systems of a motor vehicle embodying the invention; and

Fig. 2 is a schematic sectional view of a change-over valve in the braking system shown in Fig. 1.

Referring now to the drawings, there is shown in Fig. 1 the hydraulic braking and steering systems of a motor vehicle such as a tractor or an agricultural machine, the braking system comprising a brake pedal 4, a master cylinder 5 actuated by the brake pedal, a change-over valve 2 (shown in more detail in Fig. 2) connected to the master cylinder by a first, direct line and by a second line containing a pressure-limiting valve 6, rear wheel brake units 8 and 8' connected by brake lines